SHELF ADJUSTMENT MECHANISM

BACKGROUND OF THE INVENTION

This invention relates to an auxiliary support mechanisms, such as those used to support the keyboard of a personal computer. The present invention permits the angle of the auxiliary work surface to be adjusted to improve the ergonomics of the work surface.

FIELD OF THE INVENTION

Personal Computers (PCs) have become ubiquitous in many industry and office environments. The input means most commonly used appears to be the keyboard. However, it is generally thought that use of a keyboard that is not positioned properly can lead to repetitive motion injury such as carpal tunnel syndrome. Thus, it is important to be able to properly position the keyboard.

One line of advances was the development of the auxiliary support mechanisms to position, for instance, a keyboard where a PC user would find it convenient. The earliest of these was developed by Hannah *et al.* (U.S. Patent No. 4,826,123) and used a four-bar parallelogram linkage. Another approach was that of McConnell (U.S. Patent No. 5,257,767) which used a four-bar non-parallelogram trapezoidal linkages. Yet another distinctly different approach to positioning, for instance, a keyboard, was my own development (U.S. Patent No. 5,924,664) which used a five-bar mechanism including a slider joint.

Some keyboard support surfaces heretofore available have incorporated a tilt adjustment device allowing the keyboard support surface to be adjusted over a range of tilt angles. For instance, U.S. Patents Nos. 6,148,739 to Martin, 6,135,405 to Jones *et al.*, 5,961,231 to Ambrose, 5,775,657 to Hung, 5,704,299 to Corpuz, Jr., *et al.*, and 5,692,712 to Weinschenk, Jr., *et al.* Nonetheless, the range of available tilt angles available has been limited.

Ergonomists advise us that the lowest risk of repetitive motion injury occurs when the keyboard angle is slightly negative so that the bottom of the front edge (*i.e*, the edge of the keyboard closest to the user) of the keyboard is higher than the bottom of the rear edge (*i.e*, the edge of the keyboard furthest from the user) of the keyboard. Accordingly, there was a need for a shelf adjustment mechanism that provides an improved means of achieving the ergonomically desired negative tilt.

BRIEF SUMMARY OF THE INVENTION

One aspect of the present invention is to provide an adjustable support for computer keyboards and the like. In such an embodiment, the adjustable support may include a support member shaped to retain an associated keyboard thereon. The support member may be pivotally mounted to shift about a generally horizontal pivot axis to define a tilt angle for the support member and the keyboard with respect to a user, wherein the tilt angle is adjustable within a predetermined tilt range. Desirably, the tilt angle is adjustable between +10 / -25 about 0 and -15° relative to horizontal.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

FIG. 1 is a perspective view of a shelf adjustment mechanism for an adjustable support for keyboards and the like embodying the present invention;

FIG. 2 is a top view of a shelf adjustment mechanism for an adjustable support for keyboards and the like embodying the present invention;

FIG. 3 is a cross-sectional view of the shelf adjustment mechanism of FIG. 2 taken along line 200 -- 200;

FIG. 4 is a perspective view of a top member of an auxiliary shelf mounting surface for an embodiment of the present invention;

FIG. 5 is a top view of a top member for an auxiliary shelf mounting surface for an embodiment of the present invention;

FIG. 6 is a side view of a top member for an auxiliary shelf mounting surface for an embodiment of the present invention;

FIG. 7 is a perspective view of a pivoting member of an auxiliary shelf mounting surface for an embodiment of the present invention;

FIG. 8 is a side view of a pivoting member for an auxiliary shelf mounting surface for an embodiment of the present invention;

FIG. 9 is a top view of a pivoting member for an auxiliary shelf mounting surface for an embodiment of the present invention;

FIG. 10 is a perspective view of a first slotted member of an auxiliary shelf mounting surface for an embodiment of the present invention;

FIG. 11 is a top view of a first slotted member of an auxiliary shelf mounting surface for an embodiment of the present invention;

FIG. 12 is a front view of a first slotted member of an auxiliary shelf mounting surface for an embodiment of the present invention;

FIG. 13 is a side view of a first slotted member of an auxiliary shelf mounting surface for an embodiment of the present invention;

FIG. 14 is a side view of an assembly of a top member, a pivoting member and a first slotted member of an auxiliary shelf mounting surface for an embodiment of the present invention;

FIG. 15 is a side perspective view of an assembly of a top member, a pivoting member and a first slotted member of an auxiliary shelf mounting surface for an embodiment of the present invention;

FIG. 16 is a rear perspective view of an assembly of a top member, a pivoting member and a first slotted member of an auxiliary shelf mounting surface for an embodiment of the present invention;

FIG. 17 is a perspective view of a second slotted member of an auxiliary shelf mounting surface for an embodiment of the present invention;

FIG. 18 is a front view of a second slotted member of an auxiliary shelf mounting surface for an embodiment of the present invention;

FIG. 19 is a side view of a second slotted member of an auxiliary shelf mounting surface for an embodiment of the present invention;

FIG. 20 is a top view of a second slotted member of an auxiliary shelf mounting surface for an embodiment of the present invention taken along line 20 -- 20;

FIG. 21 is an exploded perspective view of a second slotted member of an auxiliary shelf mounting surface for an embodiment of the present invention and a slot insert;

FIG. 22 is a rear perspective view of a second slotted member of an auxiliary shelf mounting surface for an embodiment of the present invention and a slot insert;

FIG. 23 is an exploded perspective view of a second slotted member of an auxiliary shelf mounting surface for an embodiment of the present invention and an alternative slot insert;

FIG. 24 is a rear view of an assembly of a top member and a pivoting member of a preferred embodiment of an adjustment mechanism of the present invention;

FIG. 25 is a perspective view, taken from below and behind, showing an assembly of a top member and a pivoting member of a preferred embodiment of an adjustment mechanism of the present invention;

FIG. 26 is an enlarged view of the portion of FIG. 25 designated by circle B;

FIG. 27 is a top view of a molded washer useful in a preferred embodiment of the present invention;

FIG. 28 is a side view of a molded washer useful in a preferred embodiment of the present invention;

FIG. 29 is a perspective view of a molded washer useful in a preferred embodiment of the present invention;

FIG. 30 is a cut-away view of the molded washer of FIG. 27 taken along line A-A; and

FIG. 31 is a rear view of a molded washer useful in a preferred embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

For purposes of description herein, the terms "upper," "lower," "right," "left," "rear," "front," "vertical," "horizontal," and derivatives thereof shall relate to the invention as oriented in FIG. 1. However, it is to be understood that the invention may assume various alternative orientations and step sequences, except where expressly specified to the contrary. It is also to be understood that the specific devices and processes illustrated in the attached drawings, and described in the following specification are simply exemplary embodiments of the inventive concepts defined in the appended claims. Hence, specific dimensions and other physical characteristics relating to the embodiments disclosed herein are not to be considered as limiting,

unless the claims expressly state otherwise. Additionally, unless the context requires otherwise, similarly numbered parts in the several drawings are intended to correspond.

Turning to FIG. 1, the adjustable support mechanism **100** to which the shelf adjustment mechanism of the present invention can be incorporated includes substantially any conventional adjustable support mechanism. For instance, the adjustable support mechanism could be any of the three dramatically different styles exemplified by the parallelogram linkage of Hannah *et al.* (U.S. Patent No. 4,826,123), the four-bar non-parallelogram trapezoidal linkage of McConnell (U.S. Patent No. 5,257,767), or my five-bar mechanism including a slider joint (U.S. Patent No. 5,924,664).

FIG. 1 also shows knob **120** which moves bar **160** within slot **130**. Slot **130** is situated in the top surface of box member **150**. Box member **150** is attached to platform support **110**, and in turn pivotal member **140**.

FIG. 2 provides a top view of a preferred embodiment of the adjustment mechanism of the present invention. FIG. 2 thus shows knob **120** which moves within slot insert **130** from above. Slot insert **130** is situated in the top surface of box member **150** and is generally of a diagonal orientation. In the embodiment of the present invention illustrated in FIG. 2, the slot insert **130** (and thus the corresponding slot) is much closer to point **210** on the front surface of box member **150** that slot insert **130** (and thus the corresponding slot) is to point **220** on the front surface of box member **150**.

Again, in FIG. 2, box member **150** is preferably welded to platform support **110**.

FIG. 3 provides a cross-sectional view of the mechanism of FIG. 2 taken along line 200 -- 200. FIG. 3 reveals that knob **120** is mounted on bar **310**. This mounting is secured by mounting means **315**, which typically can be a screw, a rivet, an adhesive, or any other

conventional mechanical or chemical means of securing two components, or alternatively, knob **120** can be an integral structure of bar **310**.

Also seen in FIG. 3 is the support connecting member **360** which is joined to support **100** (not shown in this FIG.) by pivot axes that pass through apertures **350** and **355**. Pivotal member **140** is also connected to support **100** by the pivot axis that passes through aperture **350**. Mounted on top of pivotal member **140** is support member **110**.

Bar **160** runs from knob **120** through slot insert **130** in box member **150**, through slot insert **340** in support connecting member **360**, and to pivot connection **300** which connects bar **160** pivotally to support connecting member **360**. In a particularly preferred embodiment of the present invention, bar **160** is separated from support connecting member **360** by a washer **320**. It is further preferred that washer **320** is fabricated from a plastic such as palycarbonate so as to provide a frictional resistance to the movement of bar **310**.

Also shown in FIG. 3 is a spring member **330** which generally urges the support platform assembly into a preset neutral position. Desirably, spring member **330** has sufficient force to resist the deformation caused by placing an average weight keyboard on the auxiliary platform without pushing the keyboard into the steepest negative keyboard angle that can be achieved by the mechanism.

FIG. 4 shows the top perspective of platform support **110** and flanges **400**, which flanges were concealed in FIG. 1 whereas FIG. 5 shows the top view of, and FIG. 6 shows a side view of, platform support **110**.

FIG. 7 shows the top perspective of pivotal member **140** and apertures **350** on each side of pivotal member **140** for pivotally mounting pivotal member **140** to support connecting

member **360.** FIG. 8 shows the side view of, and FIG. 9 shows a top view of, pivotal member **140.**

FIG. 10 provides a prospective view of a preferred embodiment of box member **150** with slot **1030** into which slot insert **130** is to be placed. FIGs. 11, 12 and 13 show, respectively, a top, front and side view of box member **150**, and in FIGs. 11 and 12, slot **1030.** Also visible in FIGs. 10, 11, 12 and 13 is foot member **1050** of box member **150.**

FIGs. 14, 15 and 16 show, respectively a side, top perspective and rear perspective view of an assembly including platform support **110**; pivotal member **140**, and box member **150.** Note that foot member **1050** of box member 150 sits below platform support **110.**

FIGs. 17, 18, 19 & 20 show various aspects of support connecting member **360.** Specifically, FIG. 17 shows a prospective view of support connecting member **360** and illustrates left and right flanges **1750** having apertures **1720** & **1730** which admit pivot axes that connect support **100** to the shelf adjustment mechanism of the present invention in this embodiment. FIG. 17 further shows slot **1710** and apertures **1740** through which the upper and lower slot inserts are connected.

FIG. 18 shows a frontal view of support connecting member **360** with left and right flanges **1750** as well as slot **1710** and apertures **1740.** FIG. 19 shows a side view of support connecting member **360** with a side flange **1750** having apertures **1720** & **1730.**

In the embodiment of the present invention illustrated in FIGs. 17 & 18, slot **1710** is substantially parallel to the front edge of support connecting member **360** so that the shortest distance between slot **1710** and point **1760** on the front edge of support connecting member **360** is substantially the same distance as the shortest distance between slot **1710** and point **1770** on the front edge of support connecting member **360.**

FIG. 20 is a view taken along line 20 -- 20 in FIG. 19 and provides a top down view of connecting member **360** with left and right flanges **1750** as well as slot **1710** and apertures **1740.**

FIGs. 21, 22 & 23 show connecting member **360** and the placement of slot inserts **340** into slot **1710** in connecting member **360.** These figures also illustrate side flanges **1750** and their associated apertures **1720** & **1730.**

In the operation of the embodiment of the present invention illustrated in FIGs. 1 - 23, the movement of knob **120,** and thus bar **160,** toward point **170** of FIG. 1 causes box member **150** to move toward point **190** relative to support connecting member **360,** which is under box member **150.** This motion of box member **150** -- which shortens the distance between bar **160** and support member **110** -- effectively lifts the front edge of support member **110** and increases any "negative angle". Conversely, the movement of knob **120,** and thus bar **160,** toward point **180** of FIG. 1 causes box member **150** to move away from point **190** relative to support connecting member **360,** which is under box member **150.** This motion of box member **150** -- which lengthens the distance between bar **160** and support member **110** -- effectively pushes the front edge of support member **110** down, thereby decreasing the "negative angle" of the mechanism.

The motion of bar **160** between points **170** and **180** in FIG. 1 causes knob **120** to travel in an arc. In an alternative embodiment of the present invention, knob **120** is replaced with a cover mechanism that slides along the top surface of box member **150.** Desirably, this cover mechanism can accommodate the variable amount of bar **160** that projects above the top surface of box member **150** and thus this cover mechanism increases or decreases the "negative angle" of the support shelf without moving the cover mechanism out of contact with the top surface of box member **150.**

In a further embodiment of the present invention bar **160** with its anchor **300** is replaced with a slide mechanism that travels in the slots. Desirably, the slide mechanism is substantially I shaped having a bottom portion that is too wide to permit the slide mechanism to rise up out of the slots and a top portion that is too wide to permit the slide mechanism to sink down and out of the slots. In a more preferred version of this embodiment of the present invention, the underside of the top portion of the support connecting member **360** about slot **1710** has a track that engages the bottom portion of the slide mechanism so as to further prevent the slide mechanism from moving out of the slots.

Functionally this slide mechanism is substantially the equivalent of the moving bar 160 mechanism in that when the slide mechanism is moved toward point **170** of FIG. 1, this movement of the slide mechanism causes box member **150** to move toward point **190** relative to support connecting member **360**, which is under box member **150**. Again, this motion of box member **150** -- shortens the distance between bar **160** and support member **110** -- effectively lifting the rear edge of support member **110** and reducing any "negative angle". Conversely, the movement of the slide mechanism toward point **180** of FIG. 1 causes box member **150** to move away from point **190** relative to support connecting member **360**, which is under box member **150**. This motion of box member **150** -- lengthens the distance between bar **160** and support member **110** -- effectively pushes the rear edge of support member **110** down, thereby increasing the "negative angle" of the mechanism.

While the mechanism of the present invention can be fabricated out of substantially any conventional materials, it is believed that if slot inserts **340** are made of plastic such as polycarbonate, there is an improvement in the performance of the device of the present invention. Similarly, a performance improvement was observed when bar **160** was made of steel

and coated with black oxide. Likewise, if washer **320** is made of a plastic such as polycarbonate, the frictional interaction between washer **320** and bar **160** is increased so as to substantially reduce any "spontaneous" movement of bar **160** from an extreme position toward the center of the slot. It is also desired that spring member **330** is made of spring steel.

It is also desired that the lower portion of slot inserts **340** in support connecting member **360** are tapered outward so as to reduce frictional contact at that point between the slot inserts and bar **160**.

FIG. 24 illustrates a preferred embodiment of how bar **160** is pivotally connected to the inventive mechanism at pivot connection **300**. As shown in FIG. 24, bar **160** projecting through slot **340** with knob **120** at its distal end. In the preferred embodiment of the present invention shown in FIG. 24, bar **160** is separated from support connecting member **360** by a washer **320**.

FIG. 25 shows pivot connection **300** from another perspective and identifies region B which is enlarged in FIG. 26. In FIG. 26, a preferred embodiment of pivot connection **300** can be seen in greater detail. Specifically, pivot connection **300**, in this preferred embodiment, includes a machine screw **2410** that communicates through spring washer **2430** (for instance, a steel spring washer), bar **160** and support connecting member **360** to lock nut **2420** and secures bar **160** to support connecting member **360**.

FIG. 27 provides a top view of a particularly preferred embodiment of washer **320**. In this embodiment, two parallel ridges **2450** are molded into washer **320**. Also shown in this figure is washer aperture **2440**, which is offset from the center of washer **320**. but along a line that runs through the center of washer **320**.

FIG. 28 provides a side view of the preferred embodiment washer **320** shown in FIG. 27. In FIG. 28, bar **160** can be seen within the valley formed by parallel ridges **2450**.

FIG. 29 provides a further view of the preferred embodiment washer **320** shown in FIG. 27 from another perspective. Also seen in this view are washer aperture **2440** and parallel ridges **2450**.

FIG. 30 provides a cross-sectional view of washer **320** taken along line A-A in FIG. 27. This figure illustrates the valley formed by parallel ridges **2450** on washer **320**.

FIG. 31 provides a bottom view the preferred embodiment of washer **320** shown in FIGs. 27 - 30. This view shows washer aperture **2440**, which is offset from the center of washer **320**. but along a line that runs through the center of washer **320**.